CLAIMS

1. A coating composition for production of insulating film, comprising:

a) an organic polysiloxane precursor having a weight-average molecular weight ranging from 500 to 30,000;

b) an organic solvent; and

c) water.

2. The coating composition of claim 1, comprising:

a) 100 parts by weight of said organic polysiloxane precursor;

b) 200 to 2000 parts by weight of said organic solvent; and

c) 5 to 60 parts by weight of water.

3. The coating composition of claim 1, said organic polysiloxane precursor having a molar ratio of hydroxy groups 80% or more of the total condensable functional groups.

4. The coating composition of claim 1, said organic polysiloxane precursor having a molar ratio of unhydrolyzable functional groups to silicon atoms (functional group/Si) ranging from 0.35 to 0.75.

5. The coating composition of claim 1, said organic solvent being a non-alcoholic ether based solvent or a non-alcoholic ester based solvent.

6. The coating composition of claim 1, said organic polysiloxane precursor comprising one or more silane compounds selected from the group consisting of silane compounds represented by Chemical Formulas 1 to 3 below, dimers, or

oligomers prepared therefrom as a hydrolyzed and condensed repeating unit:

[Chemical Formula 1]

$$SiR^1_pR^2_{4-p}$$

where

R^1 is hydrogen, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^2 is a linear or branched C_1 to C_4 alkoxy, and

p is an integer of 1 or 2,

[Chemical Formula 2]

$$R^3_qR^4_{3-q}Si - M - SiR^5_rR^6_{3-r}$$

where

each of R^3 and R^5 is independently hydrogen, fluorine, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

each of R^4 and R^6 is independently a linear or branched C_1 to C_4 alkoxy,

M is a C_1 to C_6 alkylene or phenylene, and

each of q and r is an integer of 0 to 2, and

[Chemical Formula 3]

$$R^7_n\left[SiO\right]_mR^8_{2m-n}$$

where

R^7 is hydrogen, fluorine, an aryl, a vinyl, an allyl, or a linear or branched

C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^8 is hydrogen, a hydroxy, or a linear or branched C_1 to C_4 alkoxy or $-(CH_2)a\text{-}SiR^9R^{10}$ (where a is 2 or 3),

R^9 is fluorine, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^{10} is a linear or branched C_1 to C_4 alkoxy; and

each of m and n is an integer of 3 to 7.

7. The coating composition of claim 1, further comprising:

d) a pore generating material.

8. The coating composition of claim 7, comprising:

d) 5 to 100 parts by weight of said pore generating material

for 100 parts by weight of said organic polysiloxane precursor.

9. The coating composition of claim 7, said pore generating material being one of materials selected from a group consisting of linear organic molecules, linear organic polymers, cross-linked organic molecules, cross-linked organic polymers, hyper-branched organic molecules, hyper-branched polymers, dendrimer organic molecules, and dendrimer organic polymers that are thermally decomposable in the temperature range of 200 to 450℃.

10. A preparation method of a low dielectric insulating film comprising the steps of:

a) preparing an organic polysiloxane precursor having a weight-average

molecular weight ranging from 500 to 30,000;

b) preparing a coating composition for production of insulating film by mixing i) said organic polysiloxane precursor, ii) an organic solvent, and iii) water;

c) coating said coating composition on a substrate of a semiconductor device; and

d) drying and baking said coating composition to produce insulating film.

11. The preparation method of claim 10, said organic polysiloxane precursor prepared by mixing:

i) one or more silane compounds selected from the group consisting of silane compounds represented by Chemical Formulas 1 to 3 below, dimers, or oligomers prepared therefrom;

ii) an acid catalyst; and

iii) water or a mixture of water and an organic solvent

and hydrolyzing and condensing the same,

Chemical Formula 1

$SiR^1_pR^2_{4-p}$

where

R^1 is hydrogen, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^2 is a linear or branched C_1 to C_4 alkoxy, and

p is an integer of 1 or 2,

Chemical Formula 2

$R^3_qR^4_{3-q}Si - M - SiR^5_rR^6_{3-r}$

where

each of R^3 and R^5 is hydrogen, fluorine, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

each of R^4 and R^6 is a linear or branched C_1 to C_4 alkoxy,

M is a C_1 to C_6 alkylene or phenylene, and

each of q and r is an integer of 0 to 2, and

Chemical Formula 3

$R^7_n \left[SiO\right]_m R^8_{2m-n}$

where

R^7 is hydrogen, fluorine, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^8 is hydrogen, a hydroxy, or a linear or branched C_1 to C_4 alkoxy or $-(CH_2)a-SiR^9R^{10}$ (where, a is 2 or 3),

R^9 is fluorine, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^{10} is a linear or branched C_1 to C_4 alkoxy, and

each of m and n is an integer of 3 to 7.

12. The preparation method of claim 10, said organic polysiloxane precursor

comprising one or more silane compounds selected from the group consisting of silane compounds represented by Chemical Formulas 1 to 3 below, dimers, or oligomers prepared therefrom as hydrolyzed and condensed repeating unit:

Chemical Formula 1

$$SiR^1_pR^2_{4-p}$$

where

R^1 is hydrogen, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^2 is a linear or branched C_1 to C_4 alkoxy, and

p is an integer of 1 or 2,

Chemical Formula 2

$$R^3_qR^4_{3-q}Si - M - SiR^5_rR^6_{3-r}$$

where

each of R^3 and R^5 is hydrogen, fluorine, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

each of R^4 and R^6 is a linear or branched C_1 to C_4 alkoxy,

M is a C_1 to C_6 alkylene or phenylene, and

each of q and r is an integer of 0 to 2, and

Chemical Formula 3

$$R^7_n\left[-SiO-\right]_mR^8_{2m-n}$$

where

R^7 is hydrogen, fluorine, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^8 is hydrogen, a hydroxy, or a linear or branched C_1 to C_4 alkoxy or $-(CH_2)a\text{-}SiR^9R^{10}$ (where a is 2 or 3),

R^9 is fluorine, an aryl; a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^{10} is a linear or branched C_1 to C_4 alkoxy, and

each of m and n is an integer of 3 to 7.

13. The preparation method of claim 10, said composition comprising i) 100 parts by weight of an organic polysiloxane precursor; ii) 200 to 2000 parts by weight of an organic solvent, and iii) 4 to 60 parts by weight of water.

14. The preparation method of claim 10, said composition further comprising iv) a pore generating material.

15. The preparation method of claim 14, said composition comprising iv) 5 to 100 parts by weight of said pore generating material for 100 parts by weight of said organic polysiloxane precursor.

16. The preparation method of claim 14, said pore generating material being one of materials selected from a group consisting of linear organic molecules, linear organic polymers, cross-linked organic molecules, cross-linked organic polymers, hyper-branched organic molecules, hyper-branched polymers, dendrimer organic molecules, and dendrimer organic polymers that are

thermally decomposable in the temperature range of 200 to 450℃.

17. A low dielectric insulating film for a semiconductor device prepared as in claim 10 and comprising one or more silane compounds selected from the group consisting of silane compounds represented by Chemical Formulas 1 to 3 below, dimers, or oligomers prepared therefrom as a hydrolyzed and condensed repeating unit:

Chemical Formula 1

$SiR^1_pR^2_{4-p}$

where

R^1 is hydrogen, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^2 is a linear or branched C_1 to C_4 alkoxy and

p is an integer of 1 or 2,

Chemical Formula 2

$R^3_qR^4_{3-q}Si - M - SiR^5_rR^6_{3-r}$

where

each of R^3 and R^5 is hydrogen, fluorine, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

each of R^4 and R^6 is a linear or branched C_1 to C_4 alkoxy,

M is a C_1 to C_6 alkylene or phenylene, and

each of q and r is an integer of 0 to 2, and

Chemical Formula 3

$$R^7_n \left[SiO\right]_m R^8_{2m-n}$$

where

R^7 is hydrogen, fluorine, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^8 is hydrogen, a hydroxy, or a linear or branched C_1 to C_4 alkoxy or $-(CH_2)a\text{-}SiR^9R^{10}$ (where a is 2 or 3),

R^9 is fluorine, an aryl, a vinyl, an allyl, or a linear or branched C_1 to C_4 alkyl substituted by fluorine or unsubstituted,

R^{10} is a linear or branched C_1 to C_4 alkoxy, and

each of m and n is an integer of 3 to 7.

18. A semiconductor device comprising the low dielectric insulating film of claim 17.